INTERNATIONAL OPPORTUNITIES FOR PROJECT DEVELOPMENT: RECOVERY AND USE OF METHANE FROM COAL MINES

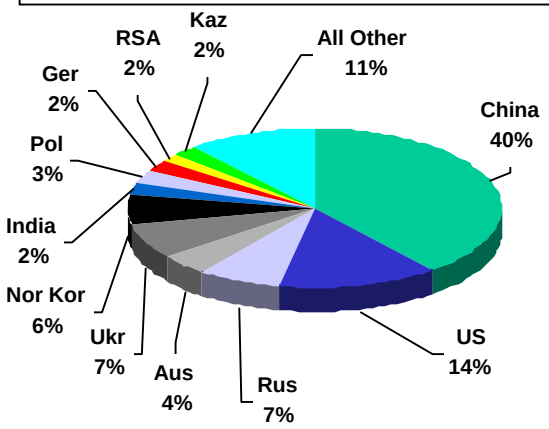
Methane is both the primary constituent of natural gas and a potent greenhouse gas when released to the atmosphere. Reducing emissions can yield substantial economic and environmental benefits. The implementation of available cost-effective methane emission reduction opportunities in the coal industry can lead to improved mine safety, greater mine productivity and increased revenues. The Methane to Markets Partnership is building international partnerships to promote these opportunities by facilitating cooperative projects that expand methane leak mitigation activities and bring more gas to markets.

BACKGROUND ON GLOBAL EMISSIONS

Methane is produced from underground mines, surface mines, and as a result of post-mining activity including coal processing, storage and transportation. Underground mines are the single largest source of coal mine methane (CMM) emissions in most countries.

Globally, CMM accounts for 8% of total methane emissions resulting from human activities. In 2000, worldwide CMM emissions totaled 440 million metric tonnes of carbon dioxide equivalent ($MMTCO_2E$) or about 30.8 billion cubic meters (BCM). By 2020, the world's coal mines are expected to produce annual emissions of 561 $MMTCO_2E$ (39.3 BCM). China and the United States, the world's largest producers of hard coal, are also the leading emitters of CMM. Other countries and regions with significant CMM emissions include Australia, Eastern Europe, Germany, India, Russia and other Eurasian countries (Kazakhstan and Ukraine), South Africa, and the United Kingdom. Other countries, such as Mexico and Vietnam, do not have large national emissions of CMM, but do have some coal mines that produce substantial volumes of CMM. Abandoned mine emissions are also significant in many of these countries.

Figure 1 – Global CMM Emissions in 2000
(440 $MMTCO_2E$)



RECOVERY AND USE OPPORTUNITIES

At active underground mines, methane must be removed from underground operations for reasons of safety. This is done by employing large-scale ventilation systems that move massive quantities of air through the mine. These ventilation systems keep the mine safe, but also release large amounts of methane at very low concentrations. In addition, at some active mines and at abandoned mines, methane is produced from degasification systems, also commonly referred to as gas drainage systems, which employ vertical and/or horizontal wells to recover methane.

Figure 2: Gob Well, which is used to extract CMM from post-mining collapsed coal seams.

There are a variety of profitable uses for CMM, and the optimal use at a given location is dependent on factors such as the quality of methane, availability of end-use options, and project economics. The range of CMM projects includes natural gas pipeline injection, electric power production, co-firing in boilers, district heating, mine heating, coal drying, vehicle fuel, flaring, and manufacturing/industrial uses such as feedstock for carbon black, methanol and dimethyl ether (DME) production. For the very low concentration methane in mine ventilation air, technological development has progressed now to the point that this CMM source can be oxidized and the resulting thermal energy can then be used to produce heat, electricity, and refrigeration.

ISSUES FOR PROJECT DEVELOPMENT

To develop successful projects, there are a range of issues that need to be addressed from project concept through installation and operation. Successful projects require a thorough methane resource assessment and gas liberation analysis, effective integration of mine degasification and utilization with mining operations, and a ready market for the methane. Although there has been substantial progress in implementing CMM projects in recent years, project developers face a range of technical, economic, and institutional issues that impede further progress. Important issues include:

- Recognizing that methane is a commodity with a practical and profitable use rather than a nuisance and safety hazard,
- Ensuring that coal mines and project developers have access to modern methane drainage and use technologies and appropriate training to make use of this valuable resource,
- Establishing an appropriate mechanism for the collection and dissemination of credible and unbiased data including technical and market information,
- Clarifying the laws, regulations and policies that govern CMM capture and use and addressing any deficiencies or limitations, and
- Providing access to capital markets.

Figure 3: Vehicle Fuel: Ukraine

The Methane to Markets Partnership will bring the collective resources and experience of Partners together to facilitate technology transfer and demonstration, policy support, capacity building and market development necessary to realize implementation of these projects and achieve further reductions in CMM emissions. By focusing international expertise and resources, the Partnership will work to:

- Engage all facets of the coal industry to improve awareness of emission reduction opportunities and the value of the recovered methane,
- Advance technology transfer to ensure the broad adoption of emission reduction technologies and management practices,
- Improve and facilitate access to capital to support project investment, and
- Cooperate with country partners to improve markets and provide legal and regulatory frameworks that encourage project development.

For much of history, methane in coal mines was viewed as a nuisance and safety hazard that had little intrinsic value. Recent projects have shown that the opposite is true: coal mine methane is an energy product and a commodity that when captured provide many benefits to the mine, the local, regional, and national communities, and the global environment.

PROJECT CASE STUDY:
JINCHENG ANTHRACITE MINING GROUP
SHANXI PROVINCE, CHINA

The Jincheng Anthracite Mining Group, Inc, located in Shanxi Province, China, is at the forefront of CMM development. By 2002, the company had 4 MW of generating capacity in place using CMM as fuel. This alone reduces greenhouse gas emissions by 81 MMTCE annually. The mine is now developing a new 120-MW CMM-based power plant. Jincheng is not only relying on its experience and expertise developing earlier projects, but is working with other organizations to finance, construct and operate the project. The Asian Development Bank and the US Trade & Development Agency are providing important financial support.

The mine produces high quality anthracite coal at several mines. The mines produce substantial volumes of CMM and have been identified as a very promising area for CMM development. In 1995, Jincheng used seven CMM wells to fuel a 4×400kW power plant. The company increased the capacity by 2×2,000kW in early 2002 by building a second CMM power plant. The power plants use 23.5 million m^3 of CMM per year, thereby reducing greenhouse gas emissions by approximately 300,000 tonnes per year. Based on its success thus far, the Jincheng Group has much more ambitious plans including a third CMM power plant with a 120MW capacity which is currently under development.

Electric Generators Operating on CMM:
Jincheng,Anthracite Mining Group, China

For more information, contact Clark Talkington at talkington.clark@epa.gov, 202-343-9484, or Pamela Franklin at franklin.pamela@epa.gov, 202-343-9476.